



Forest Insect & Disease Management

Evaluation Report

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CHANGES IN INFECTION, MORTALITY AND GROWTH RATES
IN PERMANENT SCLERODERRIS CANKER PLOTS FROM
1966 TO 1975, MICHIGAN
WITH CONTROL RECOMMENDATIONS



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INTRODUCTION

Scleroderris canker of red pine, caused by Scleroderris lagerbergii (Gremmen), first caused extensive damage in young red pine plantations in western Upper Michigan in 1951, and has since spread to most of the northern half of Michigan, Minnesota and Wisconsin (Figure 1 shows the current range of scleroderris canker). In 1966, the staff of the Michigan Department of Natural Resources established 30 permanent plots, 5 in each of 6 infected plantations, to determine the degree of infection, percentage of tree mortality, and growth rate of living trees. In 1975, the U. S. Forest Service, State and Private Forestry and the Michigan Department of Natural Resources cooperated in a resurvey of the state permanent plots to answer these stated objectives.

METHODS

The 30 original plots were established in red pine plantations less than 10-year-old, that contained active scleroderris infections but less than 50 percent tree mortality.

Five systematically-selected permanent plots were established in each plantation. Each plot was 1/12th-acre in size and had at least one infected tree. The four corners of each plot were marked with stakes; a visible marker (red stake) was placed at the edge of each plantation and located on a map. A map of the plantation and plots were prepared for future reference. In the 1966 and 1975 surveys, the following data were recorded; number of trees infected and not infected with scleroderris canker; dead or living and good or poor vigor for living trees; height of living trees and the number of trees missing.

RESULTS AND DISCUSSIONS

The scleroderris infection in the Lower Peninsula of Michigan (Otsego County) plantation (Areal, Figure 1) has increased little from the original infection as indicated by the change from 3 percent to 11 percent infections in the five plots. The percent of dead and missing trees over 10 years remained unchanged. We were unable to locate the original plots. New plots were established with a resulting decrease of 3 percent in the number of dead and missing trees. (Table 1).

In the 15 plots located in Luce, Mackinac and Chippewa Counties (Areas 2, 3, and 4, Figure 1), the percentage of trees infected increased from an average of 1 percent in 1966 to an average of 62 percent by 1975. The mortality and missing tree rate only increased by an average of 6 percent in the 10 year period (Table 1).

The 10 plots in Schoolcraft County (Areas 5 and 6, Figure 1) show a substantial tree mortality. The percentage of trees dead or missing increased from an average of 32 percent in 1966 to 71 percent in 1975. The percent infection did not increase dramatically but this may be due to the high rate of tree death (Table 1).

Regression analysis of the 30 plots as a group showed that there was no significant correlation between; the 1966 infection rate and the number of trees missing; the percent increase in infection and the mortality ten years later. The growth rate (size of tree divided by age) of the trees was not correlated with the infection increase or resulting mortality (+ test). We found that the 1966 infection rate was linear and positive correlated with the percent of dead and missing trees in 1975 ($r=+.71$). No significant growth rate difference was noted between infected and uninfected trees (+ test) (Table 1).

We did not find that the infection was associated with frost pockets.

There seemed to be two distinct areas with different rate of mortality. In order to obtain additional information on this observation, an estimate of the acres of forest land classified as nonproductive because of scleroderris canker was requested from the State and National Forests in the survey area.

The acreage estimates provided by the land managers (Table 2) substantiated the field observations. The high mortality rates in the Schoolcraft County plots and the 25,150 acres lost to scleroderris canker in the Danaher Plains (located in Schoolcraft County) area indicate an area of high hazard for scleroderris. It is assumed that most of the mortality is caused by scleroderris since the current mortality seemed to be scleroderris caused.

The land manager's reports and our field observations would indicate that the remaining infected area would be classified as moderate to light. The lower peninsula infected areas (Atrim County, Otsego County, Kalkaska County and Crawford County) had pockets of infection that may have resulted from infected stock and had moved little since the initial infection. The other areas in the moderate to low hazard zone had the disease scattered at random throughout the plantation with the rate of spread high but the mortality low.

CONCLUSIONS

There are two distinct hazard zones (Figure 2). The heavy impact zone had approximately 60-90 percent of the trees dead or missing. The moderate impact zone had 5-40 percent of the trees dead or missing.

The infection rate of spread in the lower peninsula of Michigan was light and had moved little since the initial survey.

The infection rate of spread was high in the upper peninsula of Michigan.

The growth rate of infected and noninfected trees was approximately the same.

RECOMMENDATIONS

It is recommended a different control procedure be applied in each hazard zone. The following recommendations are based on research findings by the North Central Forest Experiment Station, USDA Forest Service, St. Paul, MN 55108:

Moderate Impact Area

1. Do not replant an infected stand with red or jack pine.
2. Do not plant red or jack pine within 1/2 mile of infected stands.
3. When possible, reforest with nonsusceptible species such as white spruce and white pine within the 1/2 mile zone around infected areas.

High Mortaility Area (Danaher Plains)

1. Reforest with nonsusceptible species such as white pine and resistant Scotch whenever feasible.

Follow-up Action

The Danaher Plains area will be examined in 1976 to seek alternative control measures.

Recommendations for Research

Further pathological and silvicultural research may be needed on the Danaher Plains to determine which species may be successfully grown to get the land back into forest production.

Table 1. Scleroderris Infection and Tree Height in 20 Plots in Otsego, Luce, Mackinac, Chippewa and Schoolcraft Counties in Michigan from 1966 to 1975.

<u>County</u> <u>Survey</u> <u>Data</u>	Percent Living	Percent Dead	Height (Feet)	
	Trees Infected	or Missing	Infected	Not Infected
<u>Otsego (L.P.)</u>				
1966	3	30	6.0 ± 1.2	9.3 ± .2
1975	11	27	18.7 ± .8	19.9 ± .2
<u>Luce (U.P.)</u>				
1966	0	28	1.0 ± .03	1.2 ± .07
1975	26	37	4.0 ± .14	1.0 ± .3
<u>Mackinac (U.P.)</u>				
1966	2	11	1.75 ± .20	1.90 ± .09
1975	74	21	9.21 ± .36	8.62 ± .96
<u>Chippewa (U.P.)</u>				
1966	0	10	1.0	3.6 ± .2
1975	86	10	11.0 ± .3	13.0 ± .3
<u>Schoolcraft (U.P.)</u>				
1966	2	23	1.15 ± .06	1.60 ± .08
1975	27	70	7.0 ± .38	5.5 ± .31
<u>Schoolcraft (U.P.)</u>				
1966	1	42	2.0 ± .2	2.0 ± .3
1975	24	71	10.0 ± .5	12.0 ± 1.4

Table 2. Land Management Changes Due to Scleroderris.

Forest	Acres Lost to Scleroderris	Acres Classified as <u>Other Use</u> Because of Scleroderris
<u>National Forest</u>		
Hiawatha	30	0
<u>State Forest</u>		
Grand Sable	25,000	15,000
Michigamme	580	0
Tahquamenon	150	0
Ford River	90	90
Sturgeon River	5	0
Munuscong	10	10

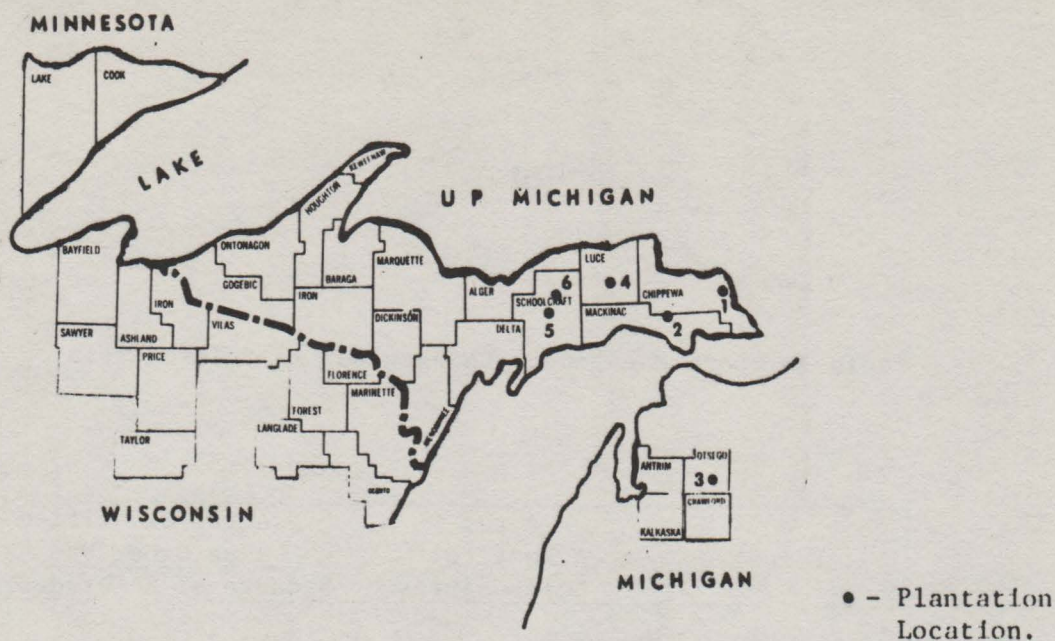


Figure 1. Area of Scleroderris (White) and Location of Sample Plantations.

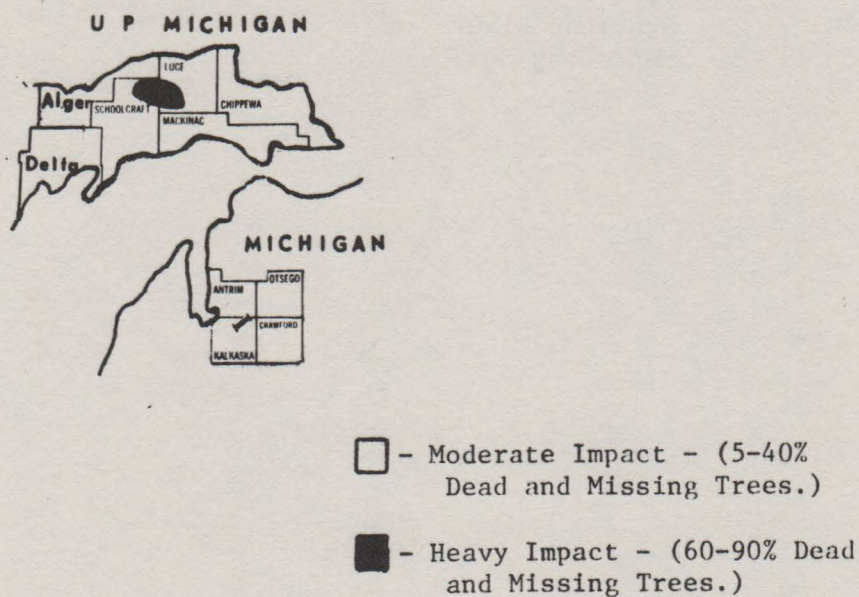


Figure 2. Scleroderris Hazard Classification.